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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/829,281  
Filing Date: April 22, 2004  
Appellant(s): ARNESS ET AL.

\_\_\_\_\_  
Michael J. Keenan  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed June 2, 2008 appealing from the Office action mailed October 5, 2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

No amendment after final has been filed.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

2,657,902	WILLIAMS	11-1953
4,672,727	FIELD	6-1987
5,269,057	MENDHAM	12-1993
2001/0012484	BEECK et al.	8-2001

2002/0197152	JACKSON et al.	12-2002
2003/0082048	JACKSON et al.	5-2003

### **(9) Grounds of Rejection**

The following grounds of rejection are applicable to the appealed claims:

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over appellant's disclosure of the prior art in view of Williams (U.S. Patent 2,657,902), Beeck (U.S. 2001/0012484) and Field (U.S. Patent 4,672,727).

Appellant discloses that nozzle airfoils having been constructed with a plurality of radially spaced apertures opening through the trailing edge in combination with radially spaced film cooling holes axially spaced from and adjacent the trailing edge to extend the operating life of the turbine nozzles to nearly twice the previous life (e.g. see "BACKGROUND OF THE INVENTION", paragraph [0002] of the specification). Appellant also discloses that turbine airfoils have been previously repaired by replacing damaged trailing edge portions with a new replacement trailing edge portion wherein coupons which constitute a replacement trailing edge portion for a nozzle airfoil have been welded to the remaining leading and intermediate sections of an airfoil after the damaged trailing edge portions have been removed. Appellant indicates that this description of the prior art differs from the claimed subject matter in that trailing edge coupons have not been utilized to significantly extend the operation life of turbine airfoils since they have lacked the required cooling configurations (e.g. see "BACKGROUND OF THE INVENTION", paragraphs [0003]-[0004] of the specification). It would have been obvious to

one of ordinary skill in the art at the time the invention was made to incorporate cooling hole improvements used in current extended life nozzle airfoils when repairing damaged nozzle airfoils in order to take advantage of the potential increase in operation life afforded by the inclusion of cooling holes. One of ordinary skill in the art would readily be motivated to incorporate current airfoil improvements into prior art airfoils, which did not originally contain these improvements, in order to gain the economic benefit of increasing operational life since cooling holes are now incorporated into airfoils for this purpose. There is an inherent motivation for one of ordinary skill in the art to update prior art products to include improvements.

Appellant's description of the prior art may differ from the pending claims in that appellant may not describe the use of chamfered walls for welding as prior art. Williams has been cited, however, to show that it is conventional in the welding art to chamfer (bevel) the edges of airfoil components to accommodate welding (e.g. see Figures 2-3; column 3, lines 38-40, 49-60). In view of Williams, it would have been obvious to one of ordinary skill in the art at the time the invention was made chamfer the edges of an airfoil repair coupon to accommodate welding operations to the main airfoil section. Appellant's description of the prior art may also differ from the pending claims in that applicant may not disclose that the use of a plurality of ribs extending between the pressure and suction sides of the coupon and direction of airflow to a plenum. Beeck, however, clearly shows that ribs are conventionally used between the pressure and suction sides of airfoils and are configured so that cooling air flows between the ribs to a radial extending plenum (e.g. see paragraph [0025] and Figures 1-2c). In view of Beeck, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use rib and radial plenum configurations in an airfoil since such configurations are disclosed to

improve cooling. Regarding claim 2, appellant may not disclose that the use of flared holes to facilitate cooling is prior art, but in any event, Field is applied to clearly show that flared cooling holes are conventional configurations in airfoils to maximize cooling (e.g. see Figures 1-16). Regarding claim 3, applicant may not disclose that these limitations are prior art, but in any event, it would have been obvious to one of ordinary skill in the art to optimize the number of openings and film cooling holes for optimum cooling effectiveness in order to extend the life of the airfoil.

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over appellant's disclosure of the prior art in view of Jackson (U.S. 2002/0197152), Jackson (U.S. 2003,0082048) or Mendham (U.S. Patent 5,269,057) and further in view of Williams (U.S. Patent 2,657,902), Beeck (U.S. 2001/0012484) and Field (U.S. Patent 4,672,727).

Appellant discloses that nozzle airfoils having been constructed with a plurality of radially spaced apertures opening through the trailing edge in combination with radially spaced film cooling holes axially spaced from and adjacent the trailing edge to extend the operating life of the turbine nozzles to nearly twice the previous life (e.g. see "BACKGROUND OF THE INVENTION", paragraph [0002] of the specification). Appellant also discloses that turbine airfoils have been previously repaired by replacing damaged trailing edge portions with a new replacement trailing edge portion wherein coupons which constitute a replacement trailing edge portion for a nozzle airfoil have been welded to the remaining leading and intermediate sections of an airfoil after the damaged trailing edge portions have been removed (e.g. see "BACKGROUND OF THE INVENTION", paragraphs [0003]-[0004] of the specification). It

would have been obvious to one of ordinary skill in the art at the time the invention was made that prior art cooled airfoils (which are disclosed by appellant to be constructed with a plurality of radially spaced apertures opening through the trailing edge in combination with radially spaced film cooling holes axially spaced from and adjacent the trailing edge) would benefit from being repaired by replacing their damaged trailing edge portions with coupons having the original configuration of the cooled airfoils in order to maintain the increase in operation life afforded by the cooling holes. Evidence that using repair coupons having cooling holes is conventional in the art is shown by Jackson '048 (e.g. Figure 9), Jackson '152 (Figure 6) and Mendham (Figure 7). Appellant's description of the prior art may differ from the pending claims in that appellant may not describe the use of chamfered walls for welding as prior art. Williams has been cited, however, to show that it is conventional in the welding art to chamfer (bevel) the edges of airfoil components to accommodate welding (e.g. see Figures 2-3; column 3, lines 38-40, 49-60). In view of Williams, it would have been obvious to one of ordinary skill in the art at the time the invention was made chamfer the edges of an airfoil repair coupon to accommodate welding operations to the main airfoil section. Appellant's description of the prior art may also differ from the pending claims in that applicant may not disclose that the use of a plurality of ribs extending between the pressure and suction sides of the coupon and direction of airflow to a plenum. Beeck, however, clearly shows that ribs are conventionally used between the pressure and suction sides of airfoils and are configured so that cooling air flows between the ribs to a radial plenum (e.g. see paragraph [0025] and Figures 1-2c). In view of Beeck, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use rib and radial plenum configurations in an airfoil since such configurations are disclosed to improve

cooling. Regarding claim 2, appellant may not disclose that the use of flared holes to facilitate cooling is prior art, but in any event, Field is applied to clearly show that flared cooling holes are conventional configurations in airfoils to maximize cooling (e.g. see Figures 1-16). Regarding claim 3, appellant may not disclose that these limitations are prior art, but in any event, it would have been obvious to one of ordinary skill in the art to optimize the number of openings and film cooling holes for optimum cooling effectiveness in order to extend the life of the airfoil. Regarding the use of appellant's description of the prior art in a rejection, it is axiomatic that consideration of the prior art cited by the examiner must, of necessity, include consideration of the admitted state of the art found in appellant's specification, *In re Davis*, 305 F.2d 501, 134 USPQ 256 (CCPA 1962); *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986). Admitted knowledge in the prior art may be used in determining patentability of the claimed subject matter, *In re Nomiya*, 509 F.2d 566, 184 USPQ 607 (CCPA 1975).

#### **(10) Response to Argument**

Regarding the rejection of claims 1-3 under 35 U.S.C. 103(a) as being unpatentable over appellant's disclosure of the prior art in view of Williams (U.S. Patent 2,657,902), Beeck (U.S. 2001/0012484) and Field (U.S. Patent 4,672,727), appellant argues that the Supreme Court in its KSR decision went on to say that it followed the Court of Appeals for the Federal Circuit's advice that "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness" (the Supreme Court quoting from the Court of Appeals for the Federal Circuit in *In re Kahn*, 78 USPQ2d 1329 (Fed. Cir. 2006)). In response to



this argument, the examiner notes that the rejection is replete with articulated reasoning and rational underpinning to support the legal conclusion of obviousness. The rejection clearly articulates that it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate cooling hole improvements (currently used in the art to extended life nozzle airfoils) when repairing damaged nozzle airfoils in order to take advantage of the potential increase in operation life afforded by the incorporation of cooling holes. The rejection clearly states that one of ordinary skill in the art would be motivated to incorporate current airfoil improvements into prior airfoils (which did not originally contain these improvements) in view of the motivational economic benefit of increasing operation life. There is an inherent motivation for one of ordinary skill in the art to update prior art products to include improvements.

Appellant further argues that it is improper to use the inventors' patent application as an instruction book on how to reconstruct the prior art. See *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1 USPQ 2d 1593 (Fed. Cir. 1987). In response to this argument, the examiner notes that it is axiomatic that consideration of the prior art cited by the examiner must, of necessity, include consideration of the admitted state of the art found in appellant's specification, *In re Davis*, 305 F.2d 501, 134 USPQ 256 (CCPA 1962); *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986). Admitted knowledge in the prior art may be used in determining patentability of the claimed subject matter, *In re Nomiya*, 509 F.2d 566, 184 USPQ 607 (CCPA 1975). The pending rejections clearly outline the motivations that one of ordinary skill in the art would have in modifying the admitted prior art.

The following has been presented in the applicant's "Background of the Invention"

(paragraphs [0002]-[0004]) as prior art:

[0002] Various configurations of trailing edge cooling systems have previously been proposed and constructed. For example, one such cooling system includes a plurality of radially spaced apertures opening through the trailing edge in combination with radially spaced film cooling holes axially spaced from and adjacent the trailing edge. The film cooling holes are provided along the pressure side, i.e., the hotter side, of the airfoil for film cooling the remaining trailing edge surfaces. Airfoils with such advanced cooling configurations have been provided in gas turbines and have extended the operating life of the turbine nozzles to nearly twice the operating hours of prior cooling configurations. As a consequence, the gas turbines may be operated, e.g., by a utility, for a significantly longer period of time before maintenance is required with the attendant cost advantages not only in terms of turbine efficiency but also turbine downtime.

[0003] Turbine airfoils have also been previously repaired by replacing damaged trailing edge portions with a new replacement trailing edge portion. Coupons which constitute a replacement trailing edge portion for a nozzle airfoil have previously been welded to the remaining leading and intermediate sections of an airfoil where the damaged trailing edge sections of the airfoil have been removed. Trailing edge coupons, however, have not heretofore been utilized to significantly extend the operating life of the turbine airfoil as they have lacked the required cooling configurations. The nozzles in current use have only a limited number of hours of operation before the airfoils of those nozzles are so severely damaged as to marginalize the efficiency of the turbine and require repair. For example, many existing turbines have airfoils with a 24,000 hour operation capability. While coupons having similar trailing edge sections as extant in the turbines can be and have been utilized as replacements for the damaged trailing sections, the hours of operational capability of the repaired nozzle airfoils have not been significantly extended and a similar operating life as the original airfoils have been anticipated.

[0004] Nozzle airfoils are typically provided in a plurality of nozzle segments arranged in a circumferential array about the turbine axis. Each segment includes inner and outer bands or platforms between which extend one or more nozzle vanes, i.e., airfoils. The segments are typically cast of expensive materials. While it is possible to replace the nozzle segments in their entirety with new nozzles, segments having improved cooling configurations permitting longer term operation, such replacement nozzle segments are prohibitively costly particularly in view of the materials and machining necessary to effect that replacement. Accordingly, there is a need for a trailing edge coupon and a method of repairing turbine airfoils which will extend the operating life of the repaired nozzles beyond the life cycle of the nozzle airfoils originally provided in the turbine.

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Therefore, it is clear that a cooling system including a plurality of radially spaced apertures opening through the trailing edge in combination with radially spaced film cooling holes axially spaced from and adjacent the trailing edge wherein the film cooling holes are provided along the pressure side, i.e., the hotter side, of the airfoil for film cooling the remaining trailing edge surfaces is admitted prior art. It is also admitted prior art that such cooling configurations results in twice the operational life of prior configurations and therefore have cost advantages. It is also clear that using coupons to replace the trailing edge portions of prior art airfoils is admitted prior art.

Appellant argues that none of the references cited by the examiner disclose or suggest a combination of cooling openings connected to a radially extending plenum with ribs that form flow channels for directing air to the plenum. Appellant argues that in Beeck, the exit passages 25 formed by choke ribs 24 do not connect to a radial plenum. Appellant argues that the cooling air must negotiate a series of offset pins 20 designed to uniformly distribute the flow of cooling air in an axial direction, i.e., in a direction toward the trailing edge. Appellant argues that the radial plenums 18 and 19 identified by Beeck are not connected to the exit passages 25. In response to appellant's arguments, the examiner notes that the pending claims use "comprising" language (e.g. independent claim 1, line 4). The term "comprising" allows for unrecited structures and/or elements such as offset pins 20 to be present in interior of the airfoil. The examiner notes that Beeck clearly describes that the interior of the airfoil has a "front radial plenum 18" (e.g. paragraph [0025]) and a "further radial plenum 19" (e.g. paragraph [0026]) which distribute cooling medium. The suction side film holes 13, pressure side film holes 15 and trailing edge openings 22 of Beeck are clearly "connected" to the radial plenums of Beeck or no

cooling medium would reach them. In any event, it is shown that the cooling medium of Beeck is directed to and from the radial plenums (18, 19) by multiple radially spaced ribs (16, 17) within the airfoil in Beeck's Figure 2.

Appellant argues that Beeck's disclosure is wholly unrelated to the design of repair coupons, and the examiner has proffered no evidence or detailed rationale to support the conclusion that one skilled in the art would have incorporated the claimed cooling configuration into a repair coupon. Appellant argues that none of Williams, Beeck or Field disclose anything with respect to the repair of trailing edge portions of airfoils. In response to appellant's arguments, the examiner notes that the common use of repair coupons to repair trailing edge portions of airfoils is admitted prior art. By arguing the secondary references individually for their failure to address the repair of airfoils, the appellant fails to address the combination of art as it is presented in the rejection. Williams, Beeck and Field have only been applied to show common configurations used in current airfoil design. Since these references show current airfoil design, they are certainly analogous to any maintenance and repair of current airfoils or the upgrading or updating of non-current airfoils. There is an inherent motivation for one of ordinary skill in the art to update prior art products to include improvements that have since been developed for those products. Appellant further argues that "even if the references can be combined as proposed, the specific trailing edge coupon cooling configuration is not produced". Appellant's statement fails to provide specific details or rationale as to why the specific trailing edge coupon cooling configuration would not be produced from the references as combined. The pending rejection clearly outlines why the claimed configuration would have been obvious to one of ordinary skill in the art at the time the invention was made.

Regarding the rejection of claims 1-3 under 35 U.S.C. 103(a) as being unpatentable over appellant's disclosure of the prior art in view of Jackson (U.S. 2002/0197152), Jackson (U.S. 2003,0082048) or Mendham (U.S. Patent 5,269,057) and further in view of Williams (U.S. Patent 2,657,902), Beeck (U.S. 2001/0012484) and Field (U.S. Patent 4,672,727), appellant argues that while Jackson '152 and Jackson '048 disclose repair inserts with cooling holes and Mendham discloses removing a trailing edge portion 14 in Fig. 7, with cooling holes 29 in the removed section, the references do not disclose the claimed configuration for the repair coupon. Appellant further argues that none of three additional references relied upon by the examiner disclose or suggest a trailing edge repair coupon as recited in the claims of this application, particularly with respect to an internal cooling configuration within the repair coupon that includes a plurality of radially spaced ribs that provide flow channels for directing cooling air to the radially extending plenum. The examiner notes that Jackson (U.S. 2002/0197152), Jackson (U.S. 2003,0082048) and Mendham (U.S. Patent 5,269,057) clearly establish that repair coupons having cooling holes are indeed now conventional in the airfoil repair art. Beeck is further applied as evidence that radial plenums and radially spaced ribs within cooled airfoils are conventional configurations in the airfoil art. Therefore, when repairing cooled airfoils, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use cooling repair coupons which have cooling configurations (plenums, ribs, cooling holes) that have already been established in the airfoil art for their effectiveness.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/John J. Zimmerman/  
Primary Examiner, Art Unit 1794

Conferees:

/Carol Chaney/  
Supervisory Patent Examiner, Art Unit 1794

/Rena L. Dye/  
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